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## INFLUENCE THE SESAR CONCEPT UPON AIR TRAFFIC SERVICES IN EUROPEAN REGION

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**Abstract.** *The article deals with the analysis of the researches conducted in field of the SESAR concept. Benefits of the concept, work packages and stakeholders of SESAR joint undertake have been reviewed. Principles of implementation and impact on air traffic services system have been analysed and general solutions appropriate for Ukraine have been proposed.*

**Keywords:** air traffic management, ATM master plan, Eurocontrol, European aeronautical system, Single European sky ATM research, Single European sky joint undertaking.

### Introduction

The Single European Sky is an ambitious initiative launched by the European Commission in 2004 to reform the architecture of European Air Traffic Management (ATM). It proposes a legislative approach to meet future capacity and safety needs at a European rather than a local level [1]. The Single European Sky initiative is the only way to provide a uniform and high level of safety and efficiency over Europe's skies.

SESAR (Single European Sky ATM Research) is the technological dimension of the Single European Sky. It will help create a 'paradigm shift', supported by state-of-the-art and innovative technology [2].

SESAR aims to eliminate the fragmented approach to European ATM, transform the ATM system, synchronise all stakeholders and federate resources.

SESAR Strategic Objectives for 2012:

- 4D trajectory is validated in an operational environment supported by satellite-based technology;
- 5,000 flights, including 500 military, are SESAR labelled;
- 80% of SESAR projects have tested their output in a real life environment;
- First SWIM pilots are in place to exchange data across at least 5 domains;
- The first remote tower is ready for operations;
- SESAR benefits are demonstrated on city pairs connecting 8 European airports;
- Airspace users have signed up to the SESAR business case for time-based operations.

Ukrainian aviation authorities should participate in SESAR activities and programs and propose their local projects, which take into account our specific conditions and problematic areas.

### SESAR programme and objectives

For the first time, all aviation players are involved in the definition, development and deployment of a pan-European modernisation project.

Key objectives are [1-5]:

- to restructure European airspace as a function of air traffic flows;
- to create additional capacity; and
- to increase the overall efficiency of the air traffic management system.

In addition to the expected contribution to European Gross Domestic Product (GDP) growth, there are direct benefits for [5]:

- *airlines*: meet demand with a better quality of service, better flight profiles and hence lower fuel consumption;
- *air navigation service providers*: provision of a better quality of service at a lower unit cost for airspace users;
- *airports*: service provision in bad weather conditions, optimised operations, capacity increase;
- *suppliers and manufacturers*: innovation and technological advancement leads to increased competitiveness for European industry, especially in aerospace.

SESAR is implemented in three phases [1-5]:

- the *SESAR Definition Phase* (2005-2008) delivered the SESAR ATM Master Plan. It was developed by a representative group of ATM stakeholders;
- the *SESAR Development Phase* (2008-2013) will produce the required new generation of technological systems, components and operational procedures as defined in the SESAR ATM Master Plan and Work Programme;

- the SESAR *Deployment Phase* (2014-2020) will see the large-scale production and implementation of the new air traffic management infrastructure, composed of fully harmonised and interoperable components guaranteeing high-performance air transport activities in Europe.

### SESAR Joint undertaking (SJU) activities

The SESAR Joint Undertaking was created under European Community law on 27 February 2007, with Eurocontrol and the European Community as founding members, in order to manage the SESAR Development Phase.

The aim of the SESAR Joint Undertaking is to ensure the modernisation of the European air traffic management system by coordinating and concentrating all relevant research and development efforts in the Community [1].

Fifteen members have now joined the SESAR Joint Undertaking: AENA, Airbus, Alenia Aeronautica, the DFS, the DSN, ENAV, Frequentis, Honeywell, INDRA, NATMIG, NATS (En Route) Limited, NORACON, SEAC, SELEX Consortium and Thales [5].

Several members are made up of consortiums, which brings the total number of organisations directly and indirectly bound to SESAR to up to 35. These 35 companies also have affiliates and sub-contractors.

As a result, a total of 70 companies from 18 countries are participating in SESAR, demonstrating the impact of the programme on ATM R&D activities in Europe.

### SESAR work packages

Using the ATM Master Plan developed during the definition phase of the SESAR Programme, the work programme defines all projects and activities to be undertaken in the 2008-2014 timeframe under the supervision of the SESAR Joint Undertaking.

The work programme, implemented through cooperation by the 16 members, comprises 16 work packages designed to provide tangible results (fig. 1) [1].

These packages will develop and deliver the necessary operational and technical materials (specifications, procedures, prototypes, validation reports, etc) for the progressive industrialisation, deployment and operation of the new ATM system.

The work programme is split into four different threads [5]:

- Operational activities are addressed under work packages (WPs) 4, 5, 6 and 7;
- System development activities are addressed under WPs 9, 10, 11, 12, 13 and 15;
- System Wide Information Management is addressed under WPs 8 and 14;

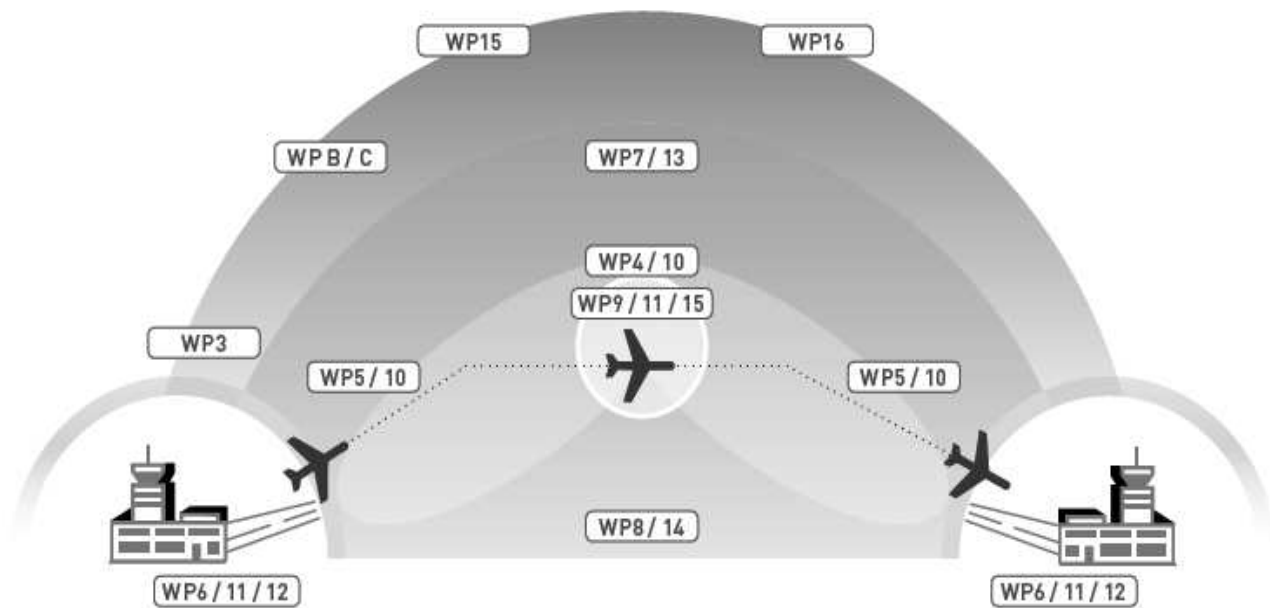


Fig. 1. SESAR JU work packages

- 'Transversal activities' – such as validation infrastructure, development of safety, security, environment and human performance cases, ATM Master Plan maintenance, target concept and architecture maintenance – are dealt with by additional WPs (i.e. B, C, 3, 16).

### **Work packages operational activities**

#### **WP 4 / En-Route Operations**

The scope of the En-Route Operations work package is to provide the operational concept description for enroute operations and perform its validation. The term 'en-route' includes both 'continental' and 'oceanic' applications (as appropriate). This covers all phases of planning and execution of flights/trajectories and the identification of supporting functions necessary for en-route operations.

#### **WP 5 / Terminal Operations**

The scope of the TMA Operations Work Package is to manage and perform all activities required to define and validate the TMA ATM Target Concept (i.e. Concept of Operations, and System Architecture). This covers all phases of planning and execution of flights/trajectories and the identification of supporting functions necessary for TMA Operations, which include the management of traffic from the top of descent until landing and from take off until the top of climb.

#### **WP 6 / Airport Operations**

The scope of the Airport Operations work package is the refinement and validation of the concept definition, as well as the preparation and coordination of its operational validation process. The Airport Operations work package will address developments associated with the 'airside' elements of airport operations only.

However, to ensure effective planning and management, landside elements (such as passenger and baggage handling) will be taken into consideration.

#### **WP 7 / Network Operations**

The scope of the Network Operations work package covers the evolution of services taking place in the business development and planning phases to prepare and support trajectory-based operations, including airspace management, collaborative flight planning and the Network Operations Plan (NOP).

### **Working packages system development**

#### **WP 9 / Aircraft Systems**

The scope of the Aircraft System work package covers the required evolutions of the aircraft platform, in particular to progressively introduce 4D Trajectory management functions in mainline, regional and business aircraft to provide very precise 4D trajectory management capabilities (three spatial dimensions, plus time). The work will also address the progressive development of Aircraft Separation Assurance and the aircraft components required for the improvement of surface movement operations.

#### **WP 10 / En-Route & Approach ATC Systems**

The scope of En-Route & Approach ATC Systems includes all R&D activities for the En-route & TMA ATC Systems evolutions. It will introduce and enhance:

- Trajectory Management functions;
- New Separation Modes;
- Controller Tools and Safety Nets;
- Airspace Management supporting functions;
- Management Complexity tools;
- Queue Management;
- Route optimisation features.

#### **WP 11 / Flight and Wing Operations Centres / Meteorological Services**

The scope of the Flight and Wing Operations Centres / Meteorological Services work package is to define and validate the requirements for the Business/Mission trajectory planning and execution processes seen from a Flight and Wing Operation Centres perspective. It also addresses the meteorological service component in increasing ATM performance, seen from a transversal perspective throughout the SESAR work programme.

#### **WP 12 / Airport Systems**

The scope of the Airport Systems work package encompasses all R&D activities aimed at delivering the Airport Systems evolution needed to support the SESAR ATM target concept. It also addresses system/technical aspects such as functional and technical architecture, technical performance & safety requirements, technical interoperability requirements, associated specifications, models/simulation platforms and prototypes, technical validation and the development of inputs/proposals to technical standards groups.

### **WP 13 / Network Information Management System**

The scope of this work package is to cover all systems R&D activities in support of three key aspects:

- ATM Network Design;
- Airspace Management;
- Aeronautical Information.

This work package will address the architectural (interoperability) and system/technical tasks required to deliver technology solutions to airspace capacity modelling, airspace design and organisation, scenario management, network demand and capacity balancing, flight planning management, demand data management, network performance management and aeronautical information distribution.

Deliverables will include specifications, models and prototypes in support of technical validation, in addition to safety, environment and standardisation work, leading to operational validation/trials.

### **WP 15 / Non-Avionic CNS System**

The Non-Avionic CNS System work package addresses the development and validation of Communication, Navigation and Surveillance (CNS) technologies, as well as considering their compatibility with the Military and General Aviation user needs.

It identifies and defines the future mobile data-link systems to serve communication and surveillance services, the ground SWIM backbone system. It addresses the best combination of GNSS and non-GNSS navigation technologies to support Performance-Based Navigation and precision approach requirements.

It contributes to the enhancement of ground surveillance systems and the introduction of new surveillance systems, as well as the use of future surveillance applications (including ADS-B applications) beyond initial operational capabilities.

### **ATM system**

The ATM Network, the ATM Infrastructure and ATM Information Management together form the ATM system, which will evolve in line with the performance requirements to deliver the performance improvements.

Figure 2 illustrates the high-level target architecture for the ATM system in Europe.

Specifically, the ATM Network which comprises airspace, airports and network management

activities will evolve, from an operational perspective, to satisfy the ATM performance needs. The changes will be oriented to implement the SESAR Operational Concept inline with the performance framework and will be aimed at delivering operational capabilities for a specific level of service. In order to achieve the ATM Service Levels, requirements will be placed on Infrastructure and Information Management to deliver capabilities to support the ATM Network.

The ATM Infrastructure is an enabler for the provision and interchange of information supporting the elements of the SESAR Operational Concept. The evolution of the existing ATM Infrastructure is determined by new operational requirements, identified for the ATM Network, emerging from future ATM concepts together with associated information distribution and performance requirements defined by ATM Information Management.

The objective of an improved infrastructure is therefore to provide a safe, efficient and cost-effective set of interoperable systems which support, in a globally compatible manner and with due regard for backward compatibility, the performance targets and the evolution of European Air Traffic Management and other identified air navigation services for the ECAC area.

In this context ATM Infrastructure includes the following:

- Airspace User systems, including aircraft systems and Airline Operations Centre (AOC) ATM systems;
- Airport systems, consisting of Aerodrome ATC system and the Airport Airside Operations system;
- En Route and TMA systems;
- ATM Regional systems, which include the Aeronautical Information Management system, the Network Information Management system, the Advanced Airspace Management system, the A/G Datalink Ground Management system (AGDLGMS) and the SWIM Supervision system, all acting at regional level

ATM Information Management will establish the framework that defines seamless information exchange between all providers and users of shared ATM information including the performance and operational requirements for system wide information sharing identified for the ATM Network. The aim of Information Management is to provide users with the right information at the right time and at the right place, enabled through the concept of net-centric ATM operations.

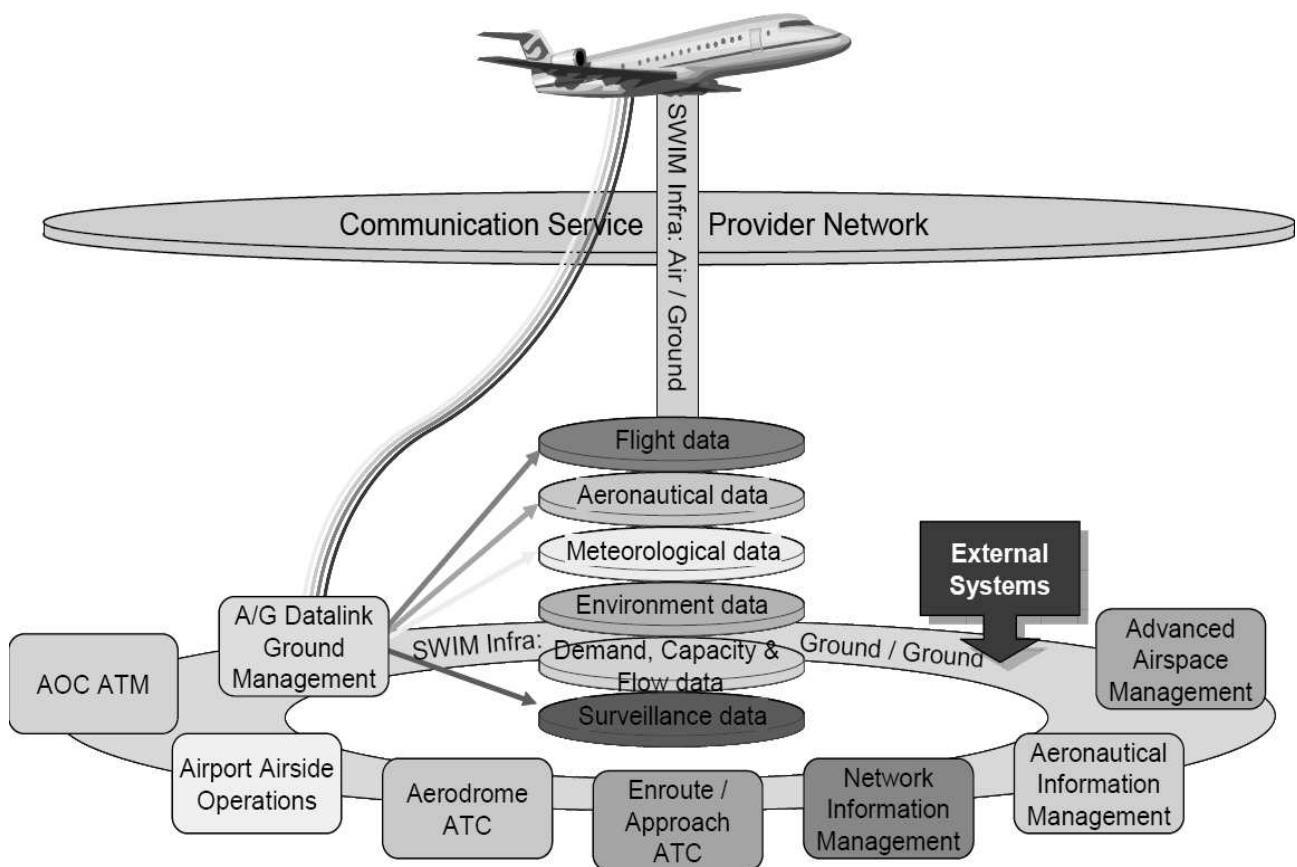


Fig. 2. SESAR ATM technical infrastructure

A System Wide Information Management (SWIM) environment underpins the entire ATM system, and is essential to its efficient operation. It includes aircraft as well as all ground facilities. It will support CDM processes using efficient end user applications to exploit the power of shared information. Fundamental to the entire ATM Target Concept is a 'net centric' operation based on:

- a powerful information handling network for sharing data;
- new air-ground data communications systems;
- an increased reliance on airborne and ground based automated support tools.

### Conclusions

Over the next eight years, the development phase will work to produce technology, standards and procedures to achieve SESAR's long term four objectives: being able to provide three times today's capacity while cutting ATM cost in half, improving safety by a factor of ten, and reducing the environmental impact of each flight by 10%.

SESAR aims to eliminate the fragmented approach to European Air Traffic Management (EATM), transform its system, synchronize all stakeholders and federate resources.

With the necessary support and regulatory measures, SESAR will re-engineer the European ATM network to achieve environmental sustainability, efficiency, full integration and cost-efficiency, resulting in maximum safety.

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